

WHAT IS CLAIMED IS:

1. A semiconductor device comprising:

a semiconductor substrate;

an active element structure formed on the
5 semiconductor substrate, and having a connection region
formed in the surface of the semiconductor substrate;

a first insulating film provided on the
semiconductor substrate;

a contact hole extending from a surface of the
10 first insulating film to the connection region;

a contact plug provided in the contact hole; and

a buried conductive film filled in a clearance
formed in the contact plug, consisting of a material
different from the contact plug, and having
15 a continuous surface without forming a step with
the surface of the contact plug.

2. The device according to claim 1, further
comprising:

a barrier metal provided in an interconnect trench
20 formed on the contact plug and the buried conductive
film, and having a bottom surface common to the upper
surface of the contact plug and the buried conductive
film; and

an interconnect layer provided in the interconnect
25 trench, and consisting of a conductive material.

3. The device according to claim 1, further
comprising:

a first intervention conductive film interposed between the inner surface of the contact hole and the contact plug.

4. The device according to claim 3, wherein the
5 buried conductive film and the first intervention conductive film consist of substantially the same material.

5. The device according to claim 4, wherein the
buried conductive film and the first intervention
10 conductive film consist substantially of a material selected from the group consisting of TiN and TiSiN or a combination thereof.

6. The device according to claim 3, wherein
the first intervention conductive film consists
15 substantially of a material selected from the group consisting of Ti, TiN and TiSiN or a stacked film containing a combination thereof, and

the buried conductive film consists substantially
of a material selected from the group consisting of
20 TiN, TiSiN, Ta and TaN or a stacked film containing a combination thereof.

7. The device according to claim 2, wherein
a film thickness of the first intervention conductive
film is equal to or less than 10% of the width of cross
25 section of the interconnect trench.

8. The device according to claim 1, wherein
the active element structure includes a transistor.

9. The device according to claim 1, wherein the contact plug consists substantially of W.

10. A semiconductor device comprising:

a semiconductor substrate;

5 an active element structure formed on the semiconductor substrate, and having a connection region formed in the surface of the semiconductor substrate;

a first insulating film provided on the semiconductor substrate;

10 a contact hole extending from a surface of the first insulating film to the connection region;

a first intervention conductive film provided on the inner surface of the contact plug;

15 a second intervention conductive film provided on the first intervention conductive film, having a film thickness of 10 nm or less, and consisting of a material different from the first intervention conductive film; and

20 a contact plug consisting substantially of Cu filled in the contact hole.

11. The device according to claim 10, further comprising:

25 an interconnect trench formed in a second insulating film on the first insulating film and connected with the contact hole, and wherein

the first and second intervention conductive films extend from the inner surface of the contact hole to

that of the interconnect trench,

the interconnect trench is filled with the same material as the contact plug.

12. The device according to claim 10, wherein
5 the first intervention conductive film consists substantially of a material selected from the group consisting of Ti, TiN and TiSiN or a stacked film containing a combination thereof.

13. The device according to claim 10, wherein
10 the second intervention conductive film consists substantially of a material selected from the group consisting of W, WN and WSiN or a stacked film containing a combination thereof.

14. A method of manufacturing a semiconductor
15 device, comprising:

forming an active element structure having a connection region on a semiconductor substrate, the connection region formed in a surface of the semiconductor substrate;

20 forming a first insulating film on the semiconductor substrate, the insulating film having a contact hole extending from a surface of the first insulating film to the connection region;

filling the contact hole with a first conductive
25 material film; and

filling a clearance that is formed in the contact hole in the process of filling the first conductive

material film with a second conductive material film to have a continuous surface without forming a step with the surface of the first conductive material film, the second conductive material film different from the first conductive material film.

15. The method according to claim 14, further comprising:

forming a third conductive material film extending along the inner surface of the contact hole and the upper surface of the first insulating film after forming the first insulating film.

16. The method according to claim 15, wherein filling the second conductive material film includes

forming the second conductive material film in the clearance and on the third conductive material film on the first insulating film,

planarizing the second conductive material film and the third conductive material film so that the third conductive material film on the first insulating film and the second conductive material film on the third conductive material film on the first insulating film are removed.

17. A method of manufacturing a semiconductor device, comprising:

forming an active element structure having a connection region on the semiconductor substrate, the connection region formed in a surface of

the semiconductor substrate;

forming a first insulating film on the
semiconductor substrate, the first insulating film
having an interconnect hole extending from a surface of
the first insulating film to the connection region;

5

forming a first intervention conductive film on
the inner surface of the interconnect hole;

forming a second intervention conductive film on
the first intervention conductive film, the second
intervention conductive film having a film thickness of
10 nm or less and consisting of a material different
from the first intervention conductive film; and

10

filling the interconnect hole with a film
consisting substantially of Cu.

15

18. The method according to claim 17, wherein
the interconnect hole includes a contact hole.

19. The method according to claim 17, wherein
the interconnect hole includes a contact hole and
an interconnect trench connected to the contact hole on
the contact hole.

20